

SCIENCE NOTEBOOK #85

APRIL 15, 1976

1. SATELLITE POWER (DOSA)
2. GAS FROM COAL (DOSA)
3. SOLAR ENERGY PLANT (DOSA)
4. JUPITER'S MAGNETIC TAIL (DOSA)
5. RAIN TO ORDER (DOSA)

ANNCR: THE VOICE OF AMERICA PRESENTS... SCIENCE NOTEBOOK ...A SUMMARY OF EVENTS IN SCIENCE, MEDICINE AND TECHNOLOGY. EACH WEEK AT THIS TIME, WE BRING YOU REPORTS ON DEVELOPMENTS THAT MAY AFFECT OUR DAILY LIVES. WITH THE FIRST STORY, HERE IS YOUR SCIENCE EDITOR -----:

(SATELLITE POWER -- 3-3231 DOSA)

EDITOR: COLLECTING SOLAR ENERGY IN SPACE AND TRANSMITTING IT TO EARTH IN THE FORM OF MICROWAVE BEAMS IS TECHNICALLY POSSIBLE AND ECONOMICALLY PROMISING, ACCORDING TO A RECENT STUDY. HERE IS ----- WITH DETAILS.

VOICE: THE USE OF SATELLITES TO TAPE THE SUNLIGHT FOR EARTHLY USES WAS PROPOSED YEARS AGO. AND NOW RESEARCHERS AT BOEING AEROSPACE COMPANY HAVE CONCLUDED THAT ELECTRIC POWER MAY BECOME THE MOST IMPORTANT PRODUCT OF SPACE TECHNOLOGY. THEY THINK THAT IN LESS THAN FIFTY YEARS, ELECTRICITY FROM SPACE COULD PROVIDE A SUBSTANTIAL PORTION OF THE UNITED STATES POWER NEEDS.

THE BOEING RESEARCHERS HAVE STUDIED THE FEASIBILITY OF A NETWORK OF SATELLITES, EACH PRODUCING TEN-THOUSAND-MILLION WATTS OF ELECTRICITY. THE COMPONENTS OF THE SATELLITES WOULD BE CARRIED BY THE U-S SPACE SHUTTLE NOW BEING DEVELOPED INTO EARTH ORBIT WHERE ASTRONAUT TECHNICIANS WOULD ASSEMBLE THEM. THE COMPLETED POWER STATIONS WOULD

VOICE: THEN BE DRIVEN BY ELECTRIC ROCKETS TO A MUCH HIGHER,
(CONT'D) EARTH-SYNCHRONOUS ORBIT WHERE THEY WOULD APPEAR TO HOVER
ALWAYS OVER THE SAME POINT ON THE SURFACE OF THE EARTH,
THE SAME WAY TODAY'S COMMUNICATIONS SATELLITES DO.

THE SATELLITE, AS ENVISIONED BY THE BOEING ENGINEERS,
WOULD BE EQUIPPED WITH NEARLY FIVE-THOUSAND HECTARES
OF MIRRORS. THE MIRRORS WOULD CONCENTRATE THE SUN'S RAYS
ON A HEAT ABSORBING DEVICE WHICH WOULD, IN TURN, DRIVE
TWELVE ELECTRIC TURBINES, EACH WITH A THREE-HUNDRED-
MILLION WATT CAPACITY.

THE ELECTRIC POWER GENERATED BY THE SATELLITE WOULD BE
CONVERTED INTO MICROWAVE ENERGY AND BEAMED BY A ONE-
THOUSAND-METER DIAMETER ANTENNA TO A RECEIVING SITE ON
EARTH. THE RECEIVER WOULD RECONVERT THE MICROWAVE ENERGY
INTO ELECTRICITY.

ACCORDING TO THE FEASIBILITY STUDY, THE POWER SATELLITE
SYSTEM WOULD COST ABOUT TWICE AS MUCH AS THE APOLLO LUNAR
LANDING PROGRAM. THE ELECTRICITY IT PRODUCES WOULD BE
SOMEWHAT MORE EXPENSIVE THAN THE POWER GENERATED BY COAL
BURNING PLANTS, BUT CHEAPER THAN ELECTRICITY PRODUCED
FROM PETROLEUM FUEL.

-0-

(GAS FROM COAL -- 3-3231 DOSA)

EDITOR: NATURAL GAS, ONE OF THE CLEANEST AND ENVIRONMENTALLY
MOST DESIRABLE FUELS, IS RUNNING OUT ON US. HERE IS

EDITOR: ----- WITH A REPORT ON A SUCCESSFUL EFFORT TO FIND A
(CONT'D) SUBSTITUTE FOR NATURAL GAS.

VOICE: THE CONTINENTAL OIL COMPANY HAS PUT INTO OPERATION A
PILOT PLANT WHICH CONVERTS A LOW GRADE LIGNITE COAL INTO
SYNTHETIC GAS WITH THE HEAT CONTENT OF NATURAL GAS.

COAL HAS BEEN A SOURCE OF GAS FOR MANY YEARS. AS EARLY
AS IN THE NINETEENTH CENTURY, COAL WAS USED IN MANY
CITIES TO PRODUCE GAS FOR COOKING AND LIGHTING. WHILE
THAT EARLY COAL GAS WAS QUITE ADEQUATE FOR ITS INTENDED
PURPOSE, IT DID NOT HAVE THE HEATING VALUE REQUIRED FOR
INDUSTRIAL NEEDS, OR FOR SPACE HEATING. IN OTHER
WORDS -- TO USE THE TERM EMPLOYED BY THE ENERGY INDUSTRY
-- COAL GAS DID NOT HAVE PIPELINE QUALITY.

ENGINEERS AND SCIENTISTS HAVE BEEN WORKING FOR YEARS TO
IMPROVE THE QUALITY OF COAL GAS. THE MEN OF CONTINENTAL
OIL COMPANY, WORKING WITH THE SUPPORT OF THE U-S ENERGY
RESEARCH AND DEVELOPMENT ADMINISTRATION, HAVE EVIDENTLY
SUCCEEDED. THEY REPORT THAT THEIR COAL GASIFICATION
PLANT IN RAPID CITY, SOUTH DAKOTA, HAS MANUFACTURED
PIPELINE QUALITY GAS SUITABLE FOR RESIDENTIAL AND COMMERCIAL
USE FROM RAW LIGNITE COAL.

THE PLANT USES A PROCESS CONSISTING OF SEVERAL STEPS TO
EXTRACT THE GAS FROM THE COAL AND TO IMPROVE ITS HEAT
VALUE TO REACH PIPELINE QUALITY. OPERATING AT FULL
CAPACITY, THE EXPERIMENTAL PLANT CAN CONVERT THIRTY-TWO
TONS OF LIGNITE COAL INTO SYNTHETIC GAS EVERY DAY.

VOICE: THE PILOT PLANT TESTING OF THE COAL GAS MANUFACTURING
(CONT'D) PROCESS IS NEARLY COMPLETE. THE NEXT STEP WILL BE
CONSTRUCTION OF A LARGE, COMMERCIAL-SCALE PLANT TO
CONVERT COAL INTO PIPELINE QUALITY GAS FOR INDUSTRIAL
AND RESIDENTIAL USE.

-0-

(SOLAR ENERGY PLANT -- 3-3231 DOSA)

EDITOR: THE UNITED STATES WILL HAVE ITS FIRST SOLAR ELECTRIC PLANT
BEFORE THE END OF THIS DECADE. ----- HAS THE STORY.

VOICE: THE U-S ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
HAS CALLED ON SEVERAL AEROSPACE MANUFACTURERS TO PREPARE
DESIGNS FOR THE CONSTRUCTION OF THE NATION'S FIRST SOLAR
THERMAL ELECTRICAL PILOT PLANT. CONSTRUCTION WOULD BEGIN
IN 1978 AND THE PLANT WOULD START GENERATING ELECTRICITY
TWO YEARS LATER.

THE PROPOSED PILOT PLANT WILL CONSIST OF A WHOLE FOREST
OF MORE THAN TWO-THOUSAND LARGE MIRRORS. SCATTERED ON A
FORTY HECTARE SITE, EACH MIRROR, OR HELIOSTAT, WILL
FOLLOW THE SUN AND FOCUS ITS RAYS ONTO A BIG BOILER ON
THE TOP OF A ONE-HUNDRED METER HIGH TOWER LOCATED AT
THE CENTER OF THE FIELD.

THE BOILER, HEATED BY THE SUN'S RAYS, WILL PRODUCE STEAM
TO DRIVE ELECTRIC POWER GENERATORS. THE PILOT PLANT
IS EXPECTED TO HAVE A GENERATING CAPACITY OF TEN-MILLION
WATTS OF ELECTRICITY. IT WILL BE HOOKED UP TO AN
EXISTING ELECTRIC POWER NETWORK.

VOICE: THE FIRST EXPERIMENTAL SOLAR POWER PLANT WILL BE LARGE
(CONT'D) ENOUGH TO MEET THE ENERGY NEEDS OF A TOWN WITH A
POPULATION OF TEN-THOUSAND PEOPLE. ENGINEERS ESTIMATE
THAT THE FACILITY WILL HEAT ENOUGH WATER DURING THE
DAY SO THAT IT WILL BE ABLE TO CONTINUE GENERATING
ELECTRICITY THROUGH THE NIGHT. BUT IF THE SUN REMAINS
HIDDEN BY CLOUDS FOR SEVERAL DAYS IN A ROW, THE ELECTRIC
OUTPUT OF THE PLANT WILL HAVE TO BE AUGMENTED FROM
OTHER ENERGY SOURCES.

IN A RELATED DEVELOPMENT, SCIENTISTS AT THE MASSACHUSETTS
INSTITUTE OF TECHNOLOGY HAVE PRODUCED NEW MATERIALS TO
IMPROVE THE EFFICIENCY OF SOLAR ENERGY COLLECTORS WHICH
CONVERT THE SUN'S ENERGY TO HEAT. DOCTOR JOHN FAN TOLD
THE RECENT NEW YORK MEETING OF THE AMERICAN CHEMICAL
SOCIETY OF THE DEVELOPMENT OF A VERY THIN, FILM-LIKE
MATERIAL WHICH ABSORBS LIGHT AND CONVERTS IT INTO HEAT.

THE NEW MATERIAL PROMISES TO BE USEFUL IN KEEPING OUR
HOMES WARMER IN THE WINTER AT A LOWER HEATING COST. THE
MATERIAL CAN BE BONDED TO THIN PLASTIC SHEETS WHICH COULD
BE ATTACHED DURING COLD WEATHER TO THE WINDOWS. IT WOULD
TRAP THE HEAT INSIDE THE HOUSE AND ALSO CONVERT THE
SUNLIGHT INTO HEAT.

DOCTOR FAN HAS BEEN EXPERIMENTING WITH A VARIETY OF
MATERIALS FOR USE IN SOLAR COLLECTORS. HE SAYS, "WE
HAVE TO LEARN TO PLAY A TRICK ON THE SUN IN ORDER TO
MAKE SOLAR ENERGY PRACTICAL."

(JUPITER'S MAGNETIC TAIL -- 3-³²³¹ DOSA)

EDITOR: PIONEER TEN, THE AMERICAN INTERPLANETARY PROBE THAT WAS THE FIRST MAN-MADE OBJECT TO FLY BY JUPITER IN DECEMBER 1973, IS STILL UNDER THE INFLUENCE OF THE HUGE PLANET. HERE IS ----- WITH AN EXPLANATION.

VOICE: PIONEER-TEN WAS LAUNCHED FROM THE KENNEDY SPACE CENTER IN MARCH, 1972. TWENTY MONTHS LATER IT FLEW BY JUPITER, SENT BACK SOME MAGNIFICENT PHOTOGRAPHS OF THE LARGEST PLANET OF OUR SOLAR SYSTEM, MADE MANY SCIENTIFIC OBSERVATIONS AND MEASUREMENTS IN ITS VICINITY, AND THEN CHANGED ITS COURSE. SPEEDED UP BY JUPITER'S GRAVITATIONAL FORCE, PIONEER TEN EMBARKED ON AN ENDLESS JOURNEY THAT WOULD EVENTUALLY TAKE IT OUT OF THE SOLAR SYSTEM.

LAST FEBRUARY, THE SMALL SPACECRAFT -- ITS INSTRUMENTS STILL WORKING -- CROSSED THE ORBIT OF SATURN. AND IN MID-MARCH, WHEN IT WAS NEARLY SEVEN-HUNDRED-MILLION KILOMETERS PAST JUPITER, SOMETHING UNEXPECTED HAPPENED.

FOR AN APPROXIMATELY TWENTY-FOUR HOUR PERIOD, PIONEER TEN'S SOLAR WIND MEASURING INSTRUMENT REPORTED A TOTAL ABSENCE OF THE PARTICLES STREAMING AT A SPEED OF ONE-AND-A-HALF-MILLION KILOMETERS AN HOUR FROM THE SUN. PIONEER PROJECT SCIENTIST JOHN WOLFE INTERPRETS THIS TO MEAN THAT PIONEER TEN ENCOUNTERED THE MAGNETIC TAIL OF JUPITER AND THAT MAGNETIC TAIL DEFLECTED THE SOLAR WIND FROM THE SPACECRAFT.

VOICE: THE MAGNETIC ENVELOPE SURROUNDING JUPITER -- AND ALSO
(CONT'D)

THE EARTH -- IS STRETCHED OUT, AWAY FROM THE SUN, BY THE FORCE OF THE SOLAR WIND. THE SURPRISING THING IS THAT THE MAGNETIC TAIL OF JUPITER GOES THAT FAR, EVEN PAST THE ORBIT OF SATURN. AND THIS DISCOVERY MEANS THAT THE PLANET SATURN, ORBITING AROUND THE SUN, ENTERS JUPITER'S MAGNETIC TAIL ONCE EVERY TWENTY YEARS. THE NEXT SUCH ENCOUNTER WILL TAKE PLACE IN APRIL 1981. THAT, ACCORDING TO DOCTOR WOLFE, SHOULD PRODUCE SOME INTERESTING MAGNETIC PHENOMENA. ARMED WITH THE KNOWLEDGE THAT SATURN WILL SAIL THROUGH JUPITER'S MAGNETIC TAIL, SCIENTISTS ON EARTH WILL BE ON THE LOOK-OUT TO SEE WHAT WILL HAPPEN.

-0-

(RAIN TO ORDER -- 3-³²³¹ DOSA)

EDITOR: SULFUR IS AN IMPORTANT CHEMICAL, BUT IT IS JUST AN OBNOXIOUS POLLUTANT WHEN IT IS IN THE AIR. AND IT MAY HAVE A HARMFUL EFFECT ON THE VEGETATION AND SOIL.
----- REPORTS ON AN EXPERIMENT TO STUDY THE HARM INFLICTED BY ATMOSPHERIC POLLUTANTS.

VOICE: SCIENTISTS AT THE OAK RIDGE NATIONAL LABORATORY IN TENNESSEE ARE USING AN ARTIFICIAL RAINMAKER TO DETERMINE WHAT SULFUR AND OTHER ATMOSPHERIC POLLUTANTS DO TO PLANTS AND SOILS. THE AUTOMATIC DEVICE CAN BE PROGRAMMED TO CONTROL THE SIZE OF RAINDROPS, THE INTENSITY WITH WHICH THEY FALL AND THEIR CHEMICAL COMPOSITION. IT HAS BEEN INSTALLED IN A GREENHOUSE WITH A CONTROLLED ENVIRONMENT

VOICE: AND MAY BE LEFT ALONE TO OPERATE UNATTENDED FOR UP TO
(CONT'D) ONE WEEK.

ORDINARILY, UNPOLLUTED RAIN IS SLIGHTLY ACID, BUT WITH COAL-FIRED POWER PLANTS RELEASING SULFUR AND SIMILAR POLLUTANTS INTO THE ATMOSPHERE, THE ACIDITY OF RAINWATER TENDS TO CHANGE. THE OAK RIDGE RAINMAKERS ADD CAREFULLY MEASURED AMOUNTS OF CHEMICAL ELEMENTS TO PURIFIED WATER TO SIMULATE ACID RAINFALL. AN IDENTICAL SYSTEM IS OPERATED AS A CONTROL AND IT SHOWERS UNPOLLUTED RAIN ON THE LABORATORY PLANTS.

PRELIMINARY STUDIES INDICATE THAT ACID RAIN MAY SIGNIFICANTLY AFFECT THE LIFE PROCESSES OF PLANTS. ONE EFFECT IS THE INCREASED LEACHING OF NUTRIENTS FROM THE LEAVES OF THE PLANTS. IT ALSO APPEARS TO MAKE CERTAIN PLANTS MORE SUSCEPTIBLE TO DISEASE.

THE OAK RIDGE SCIENTISTS WILL CONTINUE USING THE RAINMAKER TO EVALUATE ALL POSSIBLE EFFECTS OF SULFUR AND OTHER POLLUTANTS ON THE VEGETATION. THE RESULTS OF THEIR STUDY WILL INDICATE WHETHER EXISTING ENVIRONMENTAL STANDARDS ARE ADEQUATE TO PROTECT THE PLANT LIFE FROM POLLUTANTS.

ANNCR: THIS HAS BEEN... SCIENCE NOTEBOOK ...A SUMMARY OF EVENTS
IN SCIENCE, MEDICINE AND TECHNOLOGY... BROUGHT TO YOU BY
THE VOICE OF AMERICA EVERY WEEK AT THIS TIME. JOIN US
AGAIN NEXT ----- (AT THIS TIME) FOR MORE REPORTS ON
DEVELOPMENTS THAT MAY AFFECT OUR DAILY LIVES.

###

WJL/CAK